

REMARKS

In response to the Final Office Action mailed January 9, 2008, claims 1, 12, 17 and 18 are amended, and claim 13 is cancelled. Claims 2, and 5-11 were previously cancelled without prejudice. Claims 1, 3, 4, 12, and 14-18 are now active in this application. No new matter has been added.

FIG. 10 is objected to because the fourth and fifth columns allegedly should rigidly reflect the 1:4 carbon to fluorine atomic ratio of CF₄. This objection is traversed.

The Office Action, at page 2, asserts that at least the row labeled "example5" does not rigidly reflect the 1:4 carbon to fluorine atomic ratio of CF₄. Specifically, example5 states 0.02 carbon atoms to 0.1 fluorine atoms, or a ratio of 1:5, instead of the expected 1:4. Thus, there appears to be a slight excess of fluorine atoms, or a slight shortage of carbon atoms.

The Office Action states, at page 5, that in the absence of a legitimate source for the apparent slight excess of fluorine atoms, the ratio between columns 4 and 5 of FIG. 10 should reflect the rigid 1:4 carbon to fluorine atomic ratio of CF₄.

The Applicants submit that FIG. 10 appears to illustrate actual empirical measurements, and not rigid theoretical calculations. Deviations from a rigid 1:4 theoretical ratio may be caused by many sources. For example, there may be some slight contamination from another fluorocarbon, as the Office Action suggests at page 5. Alternatively, the equipment may not have been functioning precisely. Another possibility is round off error, such as 0.02 carbon atoms in example5 coming from a measurement of 0.025 which was rounded off to 0.02. Note that 0.025 would yield the expected ratio of 1:4. Also, the experimental date in FIG. 10 does not state any error ranges, and slight variations in the ratio may well be within the expected error range of the equipment used.

The previous amendments to FIG. 10, filed May 2, 2007, were predicated upon clear typographical errors (a decimal point in the wrong position). However, there do not appear to be any other clear typographical errors in FIG. 10.

Thus, Applicants submit that FIG. 10 (as previously amended) appears to accurately reflect the experimental data, and that the objection should be withdrawn.

Claims 1, 3, 4, 12, and 14-18 are rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. This rejection is traversed.

Regarding independent claims 1 and 12, the Office Action, at page 6, asserts that there is no general disclosure pertaining to the “entire” range of less than 1.0 W/cm². Specifically, the Office Action asks the question, “[s]hould one skilled in the art expect the applicant’s disclosed process to function when supplying, for example, a power as low as 0.05 W/cm² or just 0.01 W/cm²?”. This question attempts to improperly shift the burden to the Applicant. The MPEP 2163.04(I) states that, “the examiner must set forth express findings of fact which support the lack of written description conclusion.” General allegations are not adequate.

Also, please note that example 7 of FIG. 10 illustrates 0.28 W/cm², and example 8 illustrates 0.45 W/cm², which provides at least two experimental examples of very low watt density (less than 1.0 W/cm²). Applicants respectfully submit that the entire claimed range is supported by the written description.

Additionally, regarding claim 1 and FIGS. 5 and 6, the Office Action, at page 6, asserts that the disclosure contains contradictory data. Claim 1 recites, in part, “wherein said mixed gas contains nitrogen gas in an amount such that the intensity ratio A/B of said mixture is

greater than the intensity ratio A/B of pure oxygen, where A is the intensity of an emission peak caused by atomic oxygen and B is the intensity of an emission peak caused by molecular oxygen.”

Specifically, the Office Action asserts that FIG. 5 presents an A/B ratio for pure O₂ of 2.5 (where the **line with circles intersects** the y-axis for 100% oxygen and no CF₄), whereas FIG. 6 presents an A/B ratio for pure O₂ of 2.1 (where the **line with squares intersects** the y-axis for 100% oxygen and no N₂ and no CF₄). As discussed above, some variation in experimental data is quite common, and is expected.

The Office Action, at page 6, asserts that the A/B ratio of 2.4 in FIG. 6 is less than the A/B ratio for pure oxygen of 2.5 in FIG. 5. Applicants submit that the A/B ratio of pure oxygen should be constant, assuming that the temperature is constant, the pressure is constant, the equipment is constant, and so forth. The purpose of these experiments was **not** to determine an absolute or exact value of A/B for pure oxygen. Applicants submit that the experimentally measured ratio of A/B of pure oxygen may vary according to experimental conditions.

FIG. 5 clearly illustrates a peak (with values greater than for pure oxygen) in the ratio of O/O₂ in the region of between 0% and 5 % CF₄/(O₂+CF₄), as indicated by the peak in the line with circles utilizing the 777 nm and 558 nm wavelengths. This peak indicates a ratio of monoatomic oxygen with respect to diatomic oxygen (high ratio of O/O₂) which is higher than the concentration ratio of pure oxygen, which is about 2.5 in this figure. Thus, FIG. 5 is directed to mixed gases containing only oxygen and CF₄.

The Office Action, at page 6, asserts that “the increase in the A/B ratio over that of a pure oxygen plasma is clearly the result of having added the CF₄ to the O₂.” Applicants agree that this

assertion is a reasonable interpretation of FIG. 5, noting that this increase in the A/B ratio is only valid over the range between over 0% and equal to or less than about 5% CF₄/(O₂+CF₄).

The Office Action, at the last line of page 6 and the top of page 7, suggests that FIG. 6 demonstrates that “one can add up to 40% nitrogen to a gas of 1% CF₄ in O₂ without causing the A/B ratio to drop below the value that is obtained for the same gas with 1% CF₄ before O₂.” The Examiner suggests drafting claims towards this aspect of the invention.

The intersection of the line with zeroes (doped with 1% CF₄) with the y-axis represents a point with 1% CF₄ in oxygen, and with no N₂. Thus, the range of line with circles that has an increased ratio may be described as “said mixed gas contains nitrogen gas in an amount such that the intensity ratio A/B of said mixture is greater than the intensity ratio A/B of the mixed gas with no nitrogen.” In FIG. 6, the line with circles (doped with 1% CF₄) intersects the y-axis at about 2.4 emission intensity ratio, and has an emission intensity ratio (or peak) extending between an N₂ concentration of about 2.5% N₂ and about 40% N₂.

Thus, claim 1 has been amended per the Examiner’s suggestion as follows: “wherein said mixed gas contains nitrogen gas in an amount such that the intensity ratio A/B of said mixture is greater than the intensity ratio A/B of pure oxygen the mixed gas with no nitrogen, where A is the intensity of an emission peak caused by atomic oxygen and B is the intensity of an emission peak caused by molecular oxygen.” Claim 12, 17, and 20 have been amended in the same way as claim 1.

Thus, for the above reasons, Applicants submit that claims 1, 3, 4, 12, and 14-18 are described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

Claims 1, 3, 4, 12, and 14-18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Shiomi, “High-Rate Reactive Ion Etching of Diamond and Fabrication of Porous Diamond for Field-Emission Cathode” (hereinafter Shiomi), in view of U.S. Patent 6,261,726 to Brooks et al. (hereinafter Brooks), and further in view of U.S. Patent 6,013,191 to Nasser-Faili et al. (hereinafter Nasser-Faili). Applicants traverse this rejection.

Independent claims 1, 12, 17, and 18 each recite, “wherein said mixed gas contains nitrogen gas in an amount such that the intensity ratio A/B of said mixture is greater than the intensity ratio A/B of the mixed gas with no nitrogen.”

In order to establish a *prima facie* obviousness under 35 U.S.C. § 103(a), all the claim limitations must be taught or suggested by the prior art. *In re Rokya*, 490 F. 2d 981, 180 USPQ 580 (CCPA 1974). Further, “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F. 3d 977, 988 (Fed. Cir. 2006). At a minimum, the cited prior art does not disclose (expressly or inherently) the above recited limitations.

Shiomi, at page 5, line 2, merely discloses using a CF₄ concentration as low as 0.125%.

Brooks, at column 6, lines 59 to 64, merely discloses, “[e]tching high aspect ratio features with good pattern fidelity is possible using organic agents. Good results have been achieved using low pressure reactive ion etching containing oxygen, e.g., an O₂ / N₂ plasma etch. . . Optionally, additives such as CO, CO₂ or hydrocarbons may be employed.”

Nassar-Faili, at abstract, merely discloses, “the power density in the reactor is between about 1.0 watts/cm² and about 1.1 watts/cm². ”

Thus, at a minimum, the combination of Shiomi and Brooks and Nasser-Faili fails to teach or suggest the forgoing limitation, and therefore the rejection of independent claim 1, 12, 17, and 18 should be withdrawn.

Under Federal Circuit guidelines, a dependent claim is allowable if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987).

Thus, as independent claims 1, 12, 17, and 18 are allowable for the reasons set forth above, it is respectfully submitted that dependent claims 3, 4, 14, and 16 are also allowable for at least the same reasons as their respective base claims.

Independent claim 15 recites, in pertinent part, “diamond product having a projection or a depression on a surface thereof, the projection or depression having at least one side face with an **angle of inclination of at least 78 degrees.**”

The Office Action, at page 7, asserts that Shiomi teaches that the angle of the sidewall can be controlled by adding CF₄ to the etchant.

However, Shiomi does not teach or suggest an angle of inclination of at least 78 degrees, as required by independent claim 15.

Applicants submit that Brooks and Nasser-Faili do not remedy the deficiencies of Shiomi.

Thus, at a minimum, the combination of Shiomi and Brooks Nasser-Faili fails to teach or suggest the forgoing limitation, and therefore does not render independent claim 15 obvious.

Accordingly, it is urged that the application, as now amended, is in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues

that might be resolved by an interview or an Examiner's amendment, Examiner is requested to call the undersigned attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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